

CLAIMS:

1. A reading device adapted to read an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the reading device including:
  - 5 (a) a housing for mounting on at least one finger of the user in use, the housing including an aperture;
  - (b) a radiation source for illuminating the interface surface of the product item;
  - (c) a sensor provided in the housing for sensing at least some of the coded data through the aperture when the product item is positioned substantially in contact with the housing; and
  - 10 (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.
2. The reading device of claim 1, wherein the reading device includes a harness adapted to be worn by the user, the housing being fitted to the harness.
- 15 3. The reading device of claim 1, wherein the housing is a thimble.
4. The reading device of claim 1, wherein the housing includes a prism for directing radiation reflected from the product item to the sensor.
- 20 5. The reading device of claim 1, wherein the sensor is adapted to sense coded data when the interface surface is provided in a sensing region positioned adjacent the aperture.
6. The reading device of claim 5, wherein the reading device includes a focusing system to focus radiation from the sensing region on to the sensor.
- 25 7. The reading device of claim 6, wherein the focusing system includes a lens positioned between a prism and the image sensor.
8. The reading device of claim 1, wherein in use the aperture is positioned on the underside of the user's finger.
- 30 9. The reading device of claim 1, wherein in use the reading device is adapted to read interface surfaces provided in a direction substantially orthogonal to a plane defined by the user's hand.
- 35 10. The reading device of claim 1, wherein in use the aperture is positioned so as to allow the sensor to sense coded data when the user grasps a product item in use.
11. The reading device of claim 1, wherein the reading device includes an input control, and wherein the sensor is adapted to sense the coded data upon activation of the input control by at least one of:
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- (a) the user; and,
- (b) physical contact between the housing and the product item.

5 12. The reading device of claim 2, wherein the reading device further including a second housing mounted to a body portion of the harness, the processor being provided in the second housing and being coupled to the sensor by a data link.

10 13. The reading device of claim 1, wherein the coded data is printed on the interface surface in infrared ink, and the radiation source generates infrared radiation.

14. The reading device of claim 1, wherein the beam generator is an LED.

15 15. The reading device of claim 1, wherein the sensor is a 2-D image sensor which captures an image of at least a portion of the interface surface on which the illuminated coded data is disposed.

16. The reading device of claim 1, wherein the image sensor is an infrared image sensor.

20 17. The reading device of claim 1, wherein the reading device senses coded data from the interface surfaces of a number of product items substantially simultaneously.

18. The reading device of claim 1, wherein the reading device further includes a memory for storing the product identity.

25 19. The reading device of claim 1, wherein the coded data encodes an EPC associated with the product item, and wherein the processor determines the EPC.

20. The reading device of claim 1, wherein the product identity data distinguishes the product item from every other product item.

30 21. The reading device of claim 1, wherein the processor generates read data representing the identity of the read product item.

22. The reading device of claim 21, wherein the read data is the product identity data.

35 23. The reading device of claim 21, wherein the processor:

- (a) determines the product identity data of the product item during a read event; and,
- (b) generates the read data if the determined product identity data is different to product identity data determined during previous read events.

40 24. The reading device of claim 1, wherein the processor:

- (a) compares the determined product identity data to previously determined product identity data; and,
- (b) generates read data representing the identity of the product item if the determined product identity data has not been previously determined.

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25. The reading device of claim 1, wherein the coded data is redundantly encoded.

26. The reading device of claim 25, wherein the processor is adapted to use the redundantly encoded coded data to detect one or more errors in the coded data

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27. The reading device of claim 26, wherein, in response to the detection of one or more errors, the reading device performs at least one of:

- (a) correcting the one or more detected errors;
- (b) signaling a failed read; and,
- (c) ignoring the coded data.

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28. The reading device of claim 25, wherein the coded data is redundantly encoded using Reed-Solomon encoding.

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29. The reading device of claim 1, wherein the coded data is indicative of a plurality of reference points.

30. The reading device of claim 29, wherein each reference point corresponds to a respective location on the interface surface, and wherein the processor generates position data representing the position of a sensed reference point on the interface surface.

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31. The reading device of claim 1, wherein the interface surface includes at least one region, the region including coded data indicative of an identity of the region, and wherein the processor determines the identity of the at least one region from at least some of the sensed coded data.

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32. The reading device of claim 31, wherein the at least one region includes at least one coded data portion, and wherein the coded data portion is indicative of the region identity.

33. The reading device of claim 1, wherein the coded data includes at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the interface surface and the position of the coded data portion on the interface surface, and wherein the processor uses the sensed coded data portion to thereby:

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- (a) determine the identity of the interface surface;
- (b) determine position data representing at least one of:
  - (i) a position of the sensed coded data portion on the interface surface; and
  - (ii) a position of the reading device relative to the interface surface;

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- (c) determine a description of the interface surface using the determined identity; and,
- (d) identify the at least one region from the description and the position data.

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34. The reading device of claim 33, wherein the at least one region represents a user interactive element.

35. The reading device of claim 1, wherein the reading device includes a filter for filtering radiation incident on the sensor, the filter being at least one of:

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- (a) a near infrared filter;
- (b) a bandpass filter; and,
- (c) a longpass filter.

36. The reading device of claim 1, wherein the interface surface is printed using a printer, to print the information and coded data substantially simultaneously.

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37. The reading device of claim 1, wherein the reading device is adapted to detect the presence of a plurality of product items in the sensing region.

38. The reading device of claim 37, wherein the processor is adapted to:

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- (a) determine the presence of coded data during a reading event;
- (b) determine product identity data corresponding to the detected coded data; and,
- (c) activate an alarm if the determined product identity data is indicative of more than one product item.

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39. The reading device of claim 1, the coded data being disposed on or in a substrate in accordance with at least one layout, the layout having at least order  $n$  rotational symmetry, where  $n$  is at least two, the layout including  $n$  identical sub-layouts rotated  $1/n$  revolutions apart about a centre of rotational symmetry of the layout, the coded data disposed in accordance with each sub-layout including rotation-indicating data that distinguishes the rotation of that sub-layout from the rotation of at least one other sub-layout within the layout.

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40. The reading device of claim 39, wherein the rotation-indicating data of each sub-layout is adapted to distinguish the rotation of the sub-layout from the rotation of each other sub-layout.

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41. The reading device of claim 39, wherein the coded data includes at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, and wherein each coded data portion has a plurality of codewords arranged in accordance with a respective layout, the plurality of codewords being indicative of the identity of the product item.

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42. The reading device of claim 41, wherein each sub-layout has at least one codeword that is different to the codeword of each other sub-layout.

43. The reading device of claim 41, wherein each layout has at least one codeword that is different to at least one codeword of at least one other layout.

5 44. The reading device of claim 41, wherein each layout has at least one codeword that is identical to at least one codeword of at least one other layout.

45. The reading device of claim 41, wherein each codeword is formed from a number of data elements arranged in accordance with a respective sub-layout.

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46. The reading device of claim 45, wherein the data elements are arranged such that each data element has a unique position.

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47. The reading device of claim 46, wherein the positions of the data elements of respective sub-layouts are interleaved.

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48. The reading device of claim 1, the coded data being disposed on or in a substrate in accordance with at least one layout, the layout having at least order  $n$  rotational symmetry, where  $n$  is at least two, the layout encoding orientation-indicating data comprising a sequence of an integer multiple  $m$  of  $n$  symbols, where  $m$  is one or more, each encoded symbol being distributed at  $n$  locations about a centre of rotational symmetry of the layout such that decoding the symbols at each of the  $n$  orientations of the layout produces  $n$  representations of the orientation-indicating data, each representation comprising a different cyclic shift of the orientation-indicating data and being indicative of the degree of rotation of the layout.

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49. The reading device of claim 48, wherein the coded data includes at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, and wherein each coded data portion has a plurality of codewords arranged in accordance with a respective layout, the plurality of codewords being indicative of the identity of the product item.

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50. The reading device of claim 49, wherein the coded data includes a plurality of layouts of two or more layout types, each layout encoding its layout type.

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51. The reading device of claim 50, wherein each layout encodes a distributed codeword wherein fragments of the distributed codeword are distributed between the two or more layout types in a predetermined manner such that the distributed codeword can be reconstructed from fragments located in a plurality of adjacent layouts of different types

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52. The reading device of claim 1, wherein the reading device senses coded data from the interface surfaces of a number of product items substantially simultaneously.

53. The reading device of claim 1, wherein the reading device further includes a memory for storing the product identity.

54. The reading device of claim 1, wherein the interface surface is at least one of:

- 5 (a) product item packaging;
- (b) product item labelling; and,
- (c) a surface of the product item.

55. The reading device of claim 1, wherein the coded data is disposed over at least one of:

10 substantially all of any one of:

- (i) the entire product surface;
- (ii) the packaging; and,
- (iii) the label;
- (a) more than 25% of any one of:
  - 15 (i) the entire product surface;
  - (ii) the packaging; and,
  - (iii) the label;
- (b) more than 50% of any one of:
  - 20 (i) the entire product surface;
  - (ii) the packaging; and,
  - (iii) the label; and,
- (c) more than 75% of any one of:
  - 25 (i) the entire product surface;
  - (ii) the packaging; and,
  - (iii) the label.

56. A reading device adapted to read an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the reading device including:

- 30 (a) a housing for mounting on at least one finger of the user in use, the housing including an aperture;
- (b) a radiation source for illuminating the interface surface of the product item;
- (c) a sensor provided in the housing for sensing at least some of the coded data through the aperture when the product item is positioned in a sensing region adjacent the aperture; and
- 35 (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

57. The reading device of claim 56, wherein the sensing region is positioned such that the product item is in the sensing region when it is substantially in contact with the housing.

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58. The reading device of claim 56, wherein the reading device is a reading device according to claim 1.

59. A method of reading an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the method including:

- 5 (a) wearing a reading device including:
- (b) a housing mounted on the user's finger, the housing including an aperture;
- (c) a radiation source for illuminating the interface surface of the product item;
- (d) a sensor provided in the housing for sensing at least some of the coded data through the aperture when the product item is positioned in a sensing region adjacent the aperture;
- 10 (e) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item, and
- (f) positioning the finger adjacent the interface surface such that the product item is provided in the sensing region.

15 60. The method of claim 59, wherein the method includes placing the housing in contact with the sensing region.

61. The method of claim 60, wherein the method includes grasping the product item.

20 62. The method of claim 59, the method including handling the product item such that the user's finger in the finger of the harness touches the interface surface.

63. The method of claim 59, wherein the reading device includes an input control, and wherein the sensor is adapted to sense the coded data upon activation of the input control, wherein the method includes  
25 activating the input control by at least one of:

- (a) pressing an input button; and,
- (b) physically contacting the housing with the product item.

64. A system incorporating a reading device as claimed in claim 1 and a laser scanning device adapted to  
30 scan an interface surface provided on a product item, the interface surface having disposed thereon or therein coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

- 35 (a) a laser for emitting at least one scanning beam, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch, the scanning patch being provided in the sensing region such that it exposes at least one coded data portion;
- (b) a sensor for sensing the at least one exposed coded data portion; and
- 40 (c) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

65. A system incorporating a reading device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

- (a) a beam generator for emitting at least one scanning beam, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch provided in the sensing region;
- (b) at least one beam controller for directing the at least one scanning beam along selected ones of a number of patch beam paths, each patch beam path extending into the sensing region at a respective angle;
- (c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and
- (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

66. A system incorporating a reading device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

- (a) a beam generator for generating at least one scanning beam having a predetermined spectrum;
- (b) at least one beam controller for directing the at least one scanning beam into the sensing region through a scanning surface, the scanning surface being transmissive to radiation of at least a portion of the predetermined spectrum;
- (c) a sensor for sensing at least some of the coded data on the interface surface of the product item; and
- (d) generate, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

67. A system incorporating a reading device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

- (a) a beam generator for emitting at least one beam;
- (b) first and second acousto-optic deflectors for deflecting the beam in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch;
- (c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and

- (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

68. A system incorporating a reading device as claimed in claim 1 and a scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data indicative of an identity of the product item, the product item being provided in a sensing region, the scanning device including:

- (a) a beam generator for emitting at least one beam;
- (b) at least one rotating holographic optical element for selectively deflecting the beam in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch;
- (c) a sensor for sensing at least some of the coded data on the interface surface of the product item as the product item passes through the sensing region; and
- (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

69. A system incorporating a reading device as claimed in claim 1 and a laser scanning device adapted to scan an interface surface provided on a product item, the interface surface having disposed thereon coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the laser scanning device including:

- (a) a housing adapted to be held by a user in use;
- (b) a laser for emitting a scanning beam from the housing, the scanning beam being directed in first and second orthogonal directions to thereby generate a raster scan pattern over a scanning patch, the scanning patch being provided in the sensing region such that it exposes at least one coded data portion;
- (c) a sensor for sensing the at least one exposed coded data portion;
- (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.

70. A system incorporating a first reading device as claimed in claim 1 and a second reading device adapted to read an interface surface provided on a product item, the interface surface having disposed thereon coded data which includes, at a plurality of locations on the interface surface, a corresponding plurality of coded data portions, each coded data portion being indicative of an identity of the product item, the second reading device including:

- (a) a housing adapted to be held by a user in use;
- (b) a radiation source for emitting radiation from the housing such that it exposes at least one coded data portion;
- (c) an image sensor for sensing the at least one exposed coded data portion;
- (d) a processor for determining, using at least some of the sensed coded data, product identity data indicative of the identity of the product item.